Japanese Unexamined Utility Model Publication No. 3-52417 U

Publication Date: May 21, 1991

Japanese Utility Model Application No. 1-113778

Filing Date: September 28, 1989

Inventor: Hibi, Kenji; 48 Nishi Ogura, Yoro Cho, Yoro Gun, Gifu Prefecture

Inventor: Goto, Toshihide; 592-1 Nakagawa, Mori Cho, Shuchi Gun, Shizuoka Prefecture

Applicant: NTN Co., Ltd.; 1-3-17 Hori, Kyo Machi, Nishi Ku, Osaka City, Osaka Fu

Agent: Kamata, Bunji (Patent Attorney) and two others

Specification

1. Title of the Invention

Vehicle Wheel Roller Bearing

2. Claim

(1) A vehicle wheel roller bearing wherein numerous minute independent depressions are provided at random on surfaces of rolling elements or at least either rolling surfaces or sliding surfaces of inner and outer rings and wherein when axial and circumferential surface roughnesses of the surfaces where the depressions are provided are obtained to be indicated by a parameter RMS, a ratio RMS(L)/RMS(C) of axial surface roughness RMS(L) to circumferential surface roughness RMS(C) becomes 1.0 or smaller, and at the same time, a parameter SK value of surface roughness becomes -1.6 or smaller in both axial and circumferential directions.

3. Detailed Description of the Invention

[Industrial Field of Application]

The present invention relates a vehicle wheel roller bearing and more particularly to a taper roller bearing for a motor vehicle wheel which is effective in realizing torque reduction, proper seizing resistance and rigidity increase.

[Related Art]

There are used various types of taper roller bearings for motor vehicle wheels, including a conventional type in which two taper roller bearings are combined, a set right type, a taper unit type, a hub unit type and the like. In any of these types of taper roller bearings, an assembling preload is determined in consideration of torque, temperature increase, seizing resistance performance and the like.

Incidentally, there have been demands for highly rigid wheel bearings as a result of recent demands for large and high-output vehicles, and improvements have

been desired in torque reduction, temperature increase suppression and seizing resistance performance.

Conventionally, it is well known that the surface roughness of surfaces of rolling elements or rolling surfaces and sliding surfaces of inner and outer rings constitutes an important factor in extension of the service life of a wheel taper roller bearing. Thus, it has been considered to be good that the respective surfaces are finished as smooth as possible.

[Problem that the Invention is to Solve]

However, even though the surfaces of the rolling elements or the rolling surfaces of the inner and outer rings are finished smooth, it is not good enough to say that a sufficient oil film is formed at a contact portion between the rolling elements and the inner and outer rings, which would cause torque increase and temperature increase which eventually results in seizing. Thus, there is caused a problem that the increase in durability is limited.

Then, a problem to be solved by the invention is how to provide a highly rigid vehicle wheel roller bearing which enables a sufficient oil film to be formed between rolling elements and inner and outer rings so as not to reduce torque loss but also to prevent the increase in temperature to thereby meet demands for high-speed roller bearings.

[Means for Solving the Problem]

With a view to solving the problem, according to the invention, there is provided a vehicle wheel roller bearing wherein numerous minute independent depressions are provided at random on surfaces of rolling elements or at least either rolling surfaces or sliding surfaces of inner and outer rings and wherein when axial and circumferential surface roughnesses of the surfaces where the depressions are provided

are obtained to be indicated by a parameter RMS, a ratio RMS(L)/RMS(C) of axial surface roughness RMS(L) to circumferential surface roughness RMS(C) becomes 1.0 or smaller, and at the same time, a parameter SK value of surface roughness becomes -1.6 or smaller in both axial and circumferential directions.

[Function]

Either the surfaces of the rolling elements or the rolling surfaces or sliding surfaces of the inner and outer rings are each formed into the minutely roughened surface which is roughened at random. Then, the axial and circumferential surface roughnesses of the surfaces where the depressions are provided are obtained, and the ratio RMS(L)/RMS(C) of axial surface roughness RMS(L) to circumferential surface roughness RMS(C) is made to be 1.0 or smaller and the parameter SK value of surface roughness is made to be -1.6 or smaller in both the axial and circumferential directions. Therefore, the oil film forming rate at the contact portion between the rolling elements and the inner and outer rings can be increased, whereby the torque loss can be reduced and the increase in bearing temperature can be suppressed so as to prevent the seizing of the taper roller bearing. Thus, according to the invention, there is provided the vehicle wheel taper roller bearing which can realize a high-speed and highly rigid vehicle wheel taper roller bearing by enabling an increase in preload.

[Embodiment]

Hereinafter, an embodiment of the invention will be described based on the accompanying drawings.

Fig. 1 shows the construction of a wheel portion of a motor vehicle. A hub 4 is fixedly fitted on a stem 3 of a constant velocity joint which is joined to a drive shaft 1, and a knuckle 6 is supported on the hub 4 via taper roller bearings 5, 5.

In the case of the taper roller bearings 5 shown in the figure, an example is

shown in which two single-row taper bearings are combined in a face-to-face configuration and a spacer 7 is interposed therebetween.

Fig. 2 shows a specific sectional construction of the vehicle wheel roller bearing 5 in which a large number of taper roller rolling elements 8 are assembled between an outer ring 9 and an inner ring 10 and the rolling elements 8 are disposed so as to be spaced apart from each other at constant intervals by a cage 11.

In the taper roller bearing 5, surfaces of the rolling elements 8 or at least either rolling surfaces of the inner ring 10 and the outer ring 9 or an inner sliding surface of a flange 10a of the inner ring 10 is formed into a minutely roughened surface a.

In this minutely roughened surface a, when axial and circumferential roughnesses of each surface are obtained to be indicated by a parameter RMS, a ratio of axial surface roughness RMS(L)/RMS(C) of axial surface roughness RMS(L) to circumferential surface roughness RMS(C) is made to be 1.0 or range from 0.7 to 1.0 and a parameter SK value of surface roughness is made to be -1.6 in both axial and circumferential directions.

To obtain the conditions of the minutely roughened surface a, a desired finished surface can be obtained by a special barrel polishing.

The parameter SK value denotes the skewness of a distribution curve of surface roughness. Although in a symmetrical distribution like Gaussian distribution, the SK value becomes 0, the set parameter SK value of -1.6 or smaller in both the circumferential and axial directions assures that the shape and distribution of recess portions on the surface in question reside in an advantageous range for formation of an oil film.

Next, results of a service lift test will be described. The service life test was carried out on taper roller bearings B, C in which the minutely roughened surface a was

applied to surfaces of rolling elements 8 and a conventional taper roller bearing A in which surfaces of rolling elements were finished into smooth surfaces.

All the taper roller bearings A, B, C that were used in the service life test had an outer ring whose outside diameter was 72 mm and an inner ring whose inside diameter was 30 mm.

Note that a super finish was given to surfaces of rolling elements of the conventional taper roller bearing A after having been ground, and surfaces of rolling elements of the taper roller bearings B, C according to the invention were polished by a barrel to thereby be formed into a minutely roughened surface.

In addition, a radial load testing machine 21 shown in a schematic diagram in Fig. 3 was used as a testing device. The test bearing A or B, C was attached to both sides of a rotating shaft 22 of the testing machine 21. Thus, the service life test was carried out by rotating the bearings so attached while applying a load thereto.

The following are testing conditions.

Bearing Radial Load: 1800 kgf

Inner Ring Revolution Speed: 3050 rpm

Lubricant: Turbine Oil

The results of rolling element service life tests which were carried out on the respective test bearings under the aforesaid testing conditions are shown in Fig. 4.

As is obvious from the results of the tests carried out in the way described above, the taper roller bearings B, C of the invention indicated longer service lives than that of the conventional taper roller bearing A.

In addition, when the rolling elements of the test bearings were rolled, many peeling damages were found on the super-finished surfaces of the rolling elements of the conventional taper roller test bearing A, while no such damage was recognized on

the roughened surfaces of the rolling elements of the test bearings B, C according to the invention.

Figs. 5 and 6 show resultant service lives (L_{10}) obtained with respect to SK values and RMS ratio L/C.

As is shown in Fig. 5, the test bearings B, C whose SK value is -1.6 or smaller show long lives.

In addition, with respect to the axial roughness RMS (L/C), as is shown in Fig. 6, it was found that the long life was assured even at 1.0 on the test bearing C to which the special barrel polishing treatment was applied.

Next, oil film parameters Λ when the rollers of the test bearings A, B, C were combined with the rolling surfaces of their inner rings under the aforesaid testing conditions were calculated based the Grubin formula and resultant calculation values are shown in Table 1.

Table 1

Resultant Calculation Values of Parameter Λ Under the Test Conditions

	Λ
Test Bearing A	2.3
Test Bearing B	1.2
Test Bearing C	1.3

In general, a relationship shown in Fig. 7 exists between oil film parameter and oil film forming rate, and it is considered to be good that the oil film parameter is large from the viewpoint of service life. However, as is obvious from the results of the service life test, the generally accepted fact cannot be explained based on Λ only.

An accelerated peeling test was carried out to verify oil film forming situations on the finished surfaces of the rolling elements and peeling resistance performances

thereof using test pieces which had the same surface conditions as those of the test bearing B according to the invention and the conventional test bearing A under free rolling conditions by use of a double cylinder testing machine. The verification of oil film forming situations was carried out based on the direct current energization method.

Test Conditions

Maximum Contact Surface Pressure: 227 f/mm^2

Circumferential Speed: 4.3 m/sec (2000 rpm)

Lubricant: Turbine Oil

Number of Times of Repeated Loading: 4.8×10^5 (4hr)

The oil film forming rates obtained on the respective test bearings based on this test are as shown in Figs. 8 and 9. Compared with the test bearing A according to the related art, an increase of on the order of 20% in oil film forming rate was found in the oil film forming rate of the test bearing B according to the invention at the start of operation of the testing machine.

In addition, it was verified that the oil film was formed almost completely when the number of times of repeated loading reached 4.8×10^5.

Further, the generation of peeling of the order of 0.1 mm in length and propagation thereof were recognized in many locations on the super-finished surfaces of the rolling elements of the test bearing A. On the other hand, no such damage was recognized on the roughened surfaces of the rolling elements of the test bearing B according to the invention. In addition, although data is omitted herein, a similar effect was found on the bearing C, and the generation of peeling and other damages were not recognized thereon.

Next, Figs. 10 and 11 show results of measurements of bearing rotating torque which were carried out using the test bearings A, B to verify the oil film forming

situations on the taper roller bearings.

Note that a minutely roughened surface, which is roughened at random, is formed on an overall external surface of the taper roller rolling element 8 of the test bearing B according to the invention which includes an end face 8a of a large-diameter end thereof which is brought into contact with the flange 10a of the inner ring 10.

As is obvious in Figs. 10 and 11, compared wit the conventional standard bearing, the rotating torque is reduced by on the order of 30% on the taper roller bearing of the invention. Thus, the taper roller bearing of the invention exhibits a remarkable advantage particularly at a low rotation speed and in a largely loaded area where an oil film is difficult to be formed.

Next, Figs. 12 and 13 show results of a seizing resistance test which was carried out with a minute amount of lubricant by use of the test bearings A, B.

The results of the seizing resistance test shown in the figures are such that the test was carried out under test conditions of Fa=800 kgf, n=3000 rpm and an applied lubricant amount was 1cc and test results were determined at a point in time when the torque value reached a torque value which was twice as large as an initial torque value. It is found that compared with the conventional test bearing A, the test bearing B of the invention has the seizing resistance which is substantially twice as large as that of the conventional test bearing A. Almost the same torque reduction and seizing resistance improvement effects are recognized on the bearing C as well.

[Advantage]

Thus, according to the invention, at least one of the contact surfaces between the rolling elements and the inner and outer rings is formed into the minutely roughened surface which is roughened at random and the axial and circumferential roughnesses of the minutely roughened surface are suppressed to fall within the constant range.

Therefore, an oil film is easy to be formed on the minutely and randomly roughened surface, and the minute depressions formed constitute oil reservoirs, whereby the oil film formation at the contact portion between the rolling elements and the inner and outer rings is implemented in an ensured fashion. Because of this, the torque loss during rotation can be reduced and the increase in temperature of the bearing can be suppressed, which eventually prevents the generation of seizing, thereby making it possible to meet the demands for vehicle wheel high-speed taper roller bearings.

In addition, an increase in preload is enabled, whereby the rigidity of the vehicle wheel taper roller bearing can be increased, thereby making it possible to realize an increase in durability thereof.

4. Brief Description of the Drawings

Fig. 1 is a vertical sectional view showing a state in which a vehicle wheel roller bearing according to the invention is in use, Fig. 2 is an enlarged sectional view of the roller bearing, Fig. 3 is a schematic view of a testing device, Fig. 4 is a graph showing results of a rolling fatigue life test, Fig. 5 is a graph showing a relationship between SK value and lift, Fig. 6 is a graph showing a relationship between RMS(L/C) value and life, Fig. 7 is a relationship diagram showing oil film parameter and oil film forming rate, Figs. 8 and 9 are graphs showing oil film forming rate, Figs. 10 and 11 are graphs showing results of measurements of rotating torque of the conventional taper roller bearing and the taper roller bearings of the invention, and Figs. 12, 13 are graphs showing results of a seizing resistance test carried out on the conventional taper rolling bearing and the taper roller bearings of the invention.

5 taper roller bearing; 8 rolling element; 9 outer ring; 10 inner ring; a minutely roughened surface.

Applicant for Utility Model Registration: NTN Toyo Bearing Co., Ltd.

Agent for the same : Kamata, Bunji,

(Fig. 4)

累積破損確率　Accumulated Damage Rate

寿命　Life

(Fig. 5)

寿命比　Life Ratio

ころ転動面の SK 値　SK Value of Roller Rolling Surfaces

軸受　Bearing

(Fig. 6)

寿命比　Life Ratio

ころ転動面の粗さ比　Roughness Ratio of Rolling Surfaces

軸受　Bearing

(Fig. 7)

油膜形成率　Oil Film Forming Rate

油膜パラメータ　Oil Film Parameter

表面痛みが起こる範囲　Range where Surface Damage Occurs

通常の使用領域　Normal Service Area

寿命増加領域　Area where Life Extension Occurs

(Fig. 8)

油膜形成率　Oil Film Forming Rate

試験時間　Test Time

試験軸受　Test Bearing

(Fig. 9)

油膜形成率　Oil Film Forming Rate

試験時間　Test Time

試験軸受　Test Bearing

(Fig. 10)

回転トルク　Rotating Torque

回転数　Rotating Speed

潤滑ギヤ油塗布　Lubricating Gear Oil Application

(Fig. 11)

回転トルク　Rotating Torque

回転数　Rotating Speed

潤滑ギヤ油塗布　Lubricating Gear Oil Application

(Fig. 12)

焼付きまでの時間　Time to Heat Seizure

(Fig. 13)

焼付きまでの時間　Time to Heat Seizure

⑲日本国特許庁（JP）　⑪実用新案出願公開

⑫公開実用新案公報（U）　平3－52417

㊿Int. Cl.⁵	識別記号	庁内整理番号	㊸公開　平成3年(1991)5月21日
F 16 C 33/66	Z	6814－3J	
33/34		6814－3J	
33/58		6814－3J	

審査請求　未請求　請求項の数　1　（全　頁）

㊿考案の名称　車両ホイール用ころ軸受

㉑実　願　平1－113778

㉒出　願　平1(1989)9月28日

㉒考案者　日比　建治　岐阜県養老郡養老町西小倉48番地

㉒考案者　後藤　俊英　静岡県周智郡森町中川592－16

㉑出願人　エヌテイエヌ株式会社　大阪府大阪市西区京町堀1丁目3番17号

㉔代理人　弁理士　鎌田　文二　外2名

明　　細　　書

1．考案の名称

車両ホイール用ころ軸受

2．実用新案登録請求の範囲

(1) 車両ホイール用ころ軸受の転動体表面もしくは内外輪の転動面、滑り面の少なくとも一つに、微小な独立したくぼみを無数にランダムに設け、このくぼみを設けた面の面粗さを、軸方向と円周方向のそれぞれを求めてパラメータＲＭＳで表示したとき、軸方向面粗さＲＭＳ(L)と円周方向面粗さＲＭＳ(C)との比ＲＭＳ(L)/ＲＭＳ(C)が1.0以下となり、合わせて面粗さのパラメータＳＫ値が軸方向及び円周方向の何れも－1.6以下となるようにした車両ホイール用ころ軸受。

3．考案の詳細な説明

〔産業上の利用分野〕

この考案は、車両ホイール用ころ軸受、更に詳しくは、低トルク化、耐焼付性、高剛性化に有効な自動車ホイール用円すいころ軸受に関する。

〔従来の技術〕

自動車ホイール用円すいころ軸受には、2個を組合せたコンベンショナル、セットライト、テーパユニット、ハブユニット等の使用形式があるが、何れの形式も組立て予圧は、トルク、温度上昇、耐焼付性等から決定されている。

ところで、近年自動車の大型、高出力にともない、高い剛性のホイール軸受の要求があり、低トルク、低温度上昇、耐焼付性の向上が望まれている。

従来、ホイール用円すいころ軸受の長寿命化は、転動体表面もしくは内外輪の転動面や滑り面の面粗さが重要な因子であることは良く知られており、各表面の仕上げをできるだけ滑らかな面にするのがよいと考えられていた。

〔考案が解決しようとする課題〕

しかし、転動体表面や内外輪の転動面を滑らかな面に仕上げても、転動体と内外輪の接触部分における油膜形成は十分とは言えず、トルクの増大、軸受温度の上昇、ひいては焼付きなど、耐久性の向上には限界があるという問題がある。

そこで、この考案の課題は、転動体と内外輪の油膜形成が十分に行なえ、トルクロスの低減と温度上昇の防止により高速化対応が可能となる高剛性の車両ホイール用ころ軸受を提供することにある。

〔課題を解決するための手段〕

上記のような課題を解決するため、この考案は、車両ホイール用ころ軸受の転動体表面もしくは内外輪の転動面、滑り面の少なくとも一つに、微小な独立したくぼみを無数にランダムに設け、このくぼみを設けた面の面粗さを、軸方向と円周方向のそれぞれを求めてパラメータＲＭＳで表示したとき、軸方向面粗さＲＭＳ(L) と円周方向面粗さＲＭＳ(C) との比ＲＭＳ(L)/ＲＭＳ(C) が１.0以下となり、合わせて面粗さのパラメータＳＫ値が軸方向及び円周方向の何れも－１.6以下となるようにした構成としたものである。

〔作用〕

転動体表面もしくは内外輪の転動面、滑り面の少なくとも一つを、ランダムな微小粗面に形成し、

この微小粗面の仕上げ面粗さパラメータＲＭＳを軸方向(L)、円周方向(C)で求め、その比ＲＭＳ(L)/ＲＭＳ(C)を1.0以下とし、合わせてパラメータＳＫ値を軸方向、円周方向とも－1.6以下としたので、転動体と内外輪の接触部の油膜形成率が向上し、トルクロスの低減、軸受温度上昇の低減、ひいては焼付きを防止し、高速化対応が可能となり、予圧荷重のアップを可能にして高剛性化を図ることができる。

〔実施例〕

以下、この考案の実施例を添付図面に基づいて説明する。

第1図は自動車のホイール部分の構造を示しており、ドライブシャフト1に結合した等速ジョイント2のステム3にハブ4を外嵌固定し、このハブ4に円すいころ軸受5、5を介してナックル6が支持されている。

上記円すいころ軸受5は図示の場合、2個の単列円すいころを対向状に組み合せ、その間にスペーサ7を介在させた例を示している。

第2図は車両ホイール用ころ軸受5の具体的な断面構造を示しており、多数の円すいころ転動体8を外輪9と内輪10の間に組込み、保持器11で転動体8を一定の間隔に配置している。

上記の円すいころ軸受5において、転動体8の表面もしくは内輪10と外輪9の転動面及び内輪10の鍔10aの内側滑り面の少なくとも一つが、ランダムな方向の微小粗面aに形成されている。

この微小粗面aは、面粗さを各表面の軸方向と円周方向のそれぞれを求めてパラメータRMSで表示したとき、軸方向面粗さRMS(L)と円周方向面粗さRMS(C)の比RMS(L)/RMS(C)を1.0以下、例えば、0.7～1.0にすると共に、表面粗さのパラメータSK値が軸方向、円周方向とも－1.6以下になっている。

上記のような微小粗面aの条件を得るための表面加工処理は、特殊なバレル研磨によって、所望する仕上面を得ることができる。

前記パラメータSK値とは、表面粗さの分布曲線の歪み度（SKEWNESS）を指し、ガウス

分布のような対象形分布はＳＫ値が０となるが、パラメータＳＫ値を円周方向、軸方向とも－１.６以下とした設定値は、表面凹部の形状、分布が油膜形成に有利な範囲である。

次に、転動体８の表面に微小粗面ａを施した円すいころ軸受Ｂ、Ｃと、転動体の表面を滑らかな面に仕上げた従来の円すいころ軸受Ａを用いて行なった寿命試験の結果について説明する。

寿命試験に用いた円すいころ軸受Ａ、Ｂ、Ｃは共に、外輪の外径が72㎜、内輪の内径が30㎜の大きさである。

なお、従来の円すいころ軸受Ａにおける転動体の表面は、研削後にスーパーフィニッシュを施して加工され、この考案に係る円すいころ軸受Ｂ、Ｃの転動体の表面はバレル研磨特殊加工によって微小粗面ａに形成されている。

また、使用した試験装置は、第３図に概略図面で示したようなラジアル荷重試験機２１を使用し、回転軸２２の両側に試験軸受Ａ又はＢ、Ｃを取付け、回転と荷重を与えて試験を行うものである。

また、試験条件は以下の通りである。

軸受ラジアル荷重	1800kgf
内輪回転数	3050rpm
潤滑剤	タービン油

以上の条件で各試験軸受に対して行なった転動体寿命試験の結果を第4図に示す。

上記のような試験結果から明らかなように、従来の円すいころ軸受Aに比べ、この考案の円すいころ軸受B、Cは長寿命を示した。

また、上仕上面と粗面の転動のとき、上仕上面側にピーリング損傷が見られることが多いが、この考案の試験軸受B、Cにも認められなかった。

第5図と第6図は、試験軸受A、B、CのSK値、RMSのL／Cと寿命（L_{10}）を求めた結果を示している。

第5図の如く、SK値－1.6以下の試験軸受B、Cでは長寿命を示している。

また、軸方向粗さRMS（L／C）は、第6図の如くバレル研磨特殊加工軸受Cの1.0でも長寿命であることが判明した。

次に上記試験条件下において、試験軸受Ａ、Ｂ、Ｃのころと内輪転動面との組合せによるGrubinの式に基づく油膜パラメータΛの計算値を表１に示す。

表　1

試験条件における油膜パラメータΛの計算結果

	Λ
試験軸受Ａ	2.3
試験軸受Ｂ	1.2
試験軸受Ｃ	1.3

一般に油膜パラメータと油膜形成率には第７図に示す関係があり、寿命の観点からも油膜パラメータは大きい方が良いと言われているが、寿命試験結果からも明らかな通り、一概にΛだけでは説明できない。

転動体仕上面の油膜形成状況の確認及び耐ピーリング性について、２円筒の試験機を用いて、自由転がり条件下で、この考案の試験軸受Ｂ及び試験軸受Ａと同一の表面状態の試験片を用いて加速ピーリング試験を行なった。油膜形成状態の確認

は、直流通電方式により行なった。

試験条件

最大接触面圧	227f/mm^2
周速	4.2m/sec(2000rpm)
潤滑剤	タービン油
繰り返し負荷回数	4.8×10^5(4hr)

この試験による油膜の形成率は、第8図と第9図に示す通りであり、この考案の試験軸受Bの仕上面の油膜形成率は、試験軸受Aに比較して運転開始時で20%程度油膜形成率が向上した。

また、繰り返し負荷回数1.2×10^5 でほぼ完全に油膜を形成することが確認された。

更に、試験軸受Aの仕上面では、長さ0.1mm程度のピーリングの発生、進展が多数認められるのに対し、この考案の試験軸受Bの仕上面では、損傷は認められなかった。また、データは省略したが、軸受Cにおいても同様な効果があり、ピーリングの発生、損傷は見られなかった。

次に、円すいころ軸受の油膜形成状況を確認するため、上記試験軸受AとBを用いて行なった軸

受回転トルクの測定結果を第10図と第11図に示す。

なお、この考案の試験軸受Bにおける円すいころ転動体8は、内輪10の鍔10aに接触する大径端面8aを含む外面全体にランダムな微小粗面が形成されている。

第10図と第11図で明らかな如く、この考案の円すいころ軸受は、従来の標準軸受に比べ、回転トルクは30％程低下する。特に油膜の形成しにくい低速、大荷重領域で効果が大きい。

次に、上記試験軸受AとBを用い、微量潤滑油での耐焼付性試験を行なった結果を第12図と第13図に示している。

この耐焼付性試験は、F_a＝800kgf、n＝3000rpm、潤滑ギヤ油1cc塗布の条件で、初期トルク値の二倍に達した時点で判定した結果であり、従来の試験軸受Aに比べてこの考案の試験軸受Bは略2倍の耐焼付性があることがわかる。軸受Cにおいても同程度のトルク低減、耐焼付性の効果が認められている。

〔効果〕

以上のように、この考案によると、車両ホイール用ころ軸受における転動体と内外輪の接触面の少なくとも一つの面をランダムな微小粗面に形成し、この微小粗面の軸方向及び円周方向の粗さを一定範囲に抑えるようにしたので、ランダムな微小粗面は油膜を形成しやすく、しかも微小なくぼみが油溜りとなるため、転動体と内外輪の接触部分の油膜形成が確実に行なえ、回転時のトルクロスを低減し、軸受の温度上昇を抑え、ひいては焼付きの発生を防止し、高速化対応が可能になる。

また、予圧荷重のアップが可能になり、高剛性化でき、耐久性の向上を図ることができる。

4．図面の簡単な説明

第1図はこの考案に係る車両ホイール用ころ軸受の使用状態を示す縦断面図、第2図はころ軸受の拡大断面図、第3図は試験装置の概略図面、第4図は転動疲労寿命試験の結果を示すグラフ、第5図はＳＫ値と寿命の関係を示すグラフ、第6図はＲＭＳ（Ｌ／Ｃ）値と寿命の関係を示すグラフ、第7図は油膜パラメータと油膜形成率を示す関係

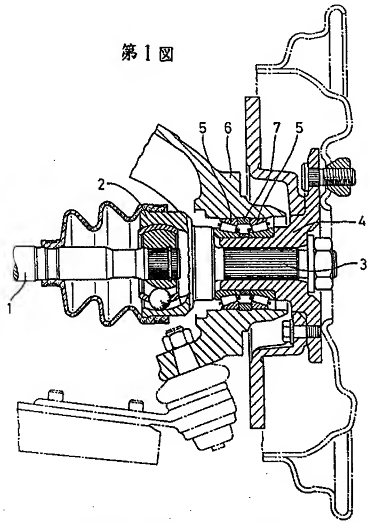
図、第8図と第9図は油膜形成率を示すグラフ、第10図と第11図は従来の円すいころ軸受とこの考案の円すいころ軸受の回転トルクの測定結果を示すグラフ、第12図と第13図は同じく耐焼付性試験の結果を示すグラフである。

5……円すいころ軸受、　8……転動体、
9……外輪、　１０……内輪、
a……微小粗面。

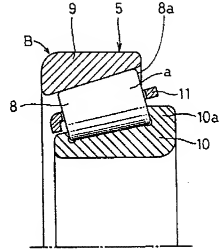
実用新案登録出願人　エヌ・テー・エヌ
東洋ベアリング株式会社

同　代理人　鎌　田　文　二

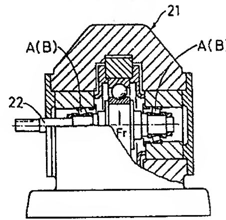
第1図



第2図

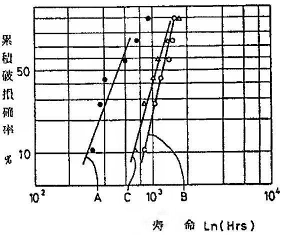


第3図

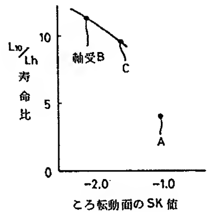


出願人代理人 鎌田文二
実開3－52417

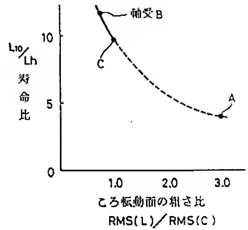
第4図



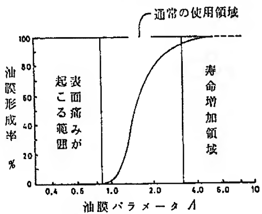
第5図



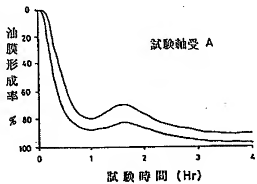
第6図



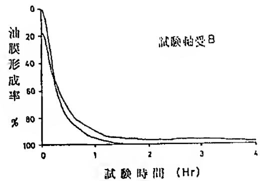
第7図



第8図

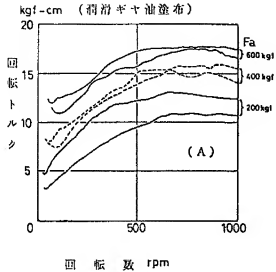


第9図

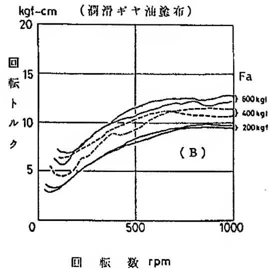


出願人代理人 鎌田文二
実開3- 52417

第10図

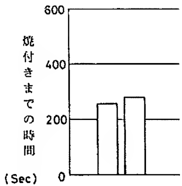


第11図



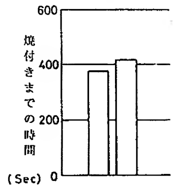
第12図

(A)



第13図

(B)



実開3- 52417

出願人代理人 鎌田文二